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ABSTRACT

Portfolios provide a means to represent excellence and variety in the work of one preparing to be a teacher. This paper reviews the implementation of portfolios with preservice teachers and describes appropriate electronic artifacts for inclusion in an electronic portfolio. Teaching portfolios are typically composed of artifacts, reproductions, productions, and attestations. Electronic portfolios can contain video, dialogues, simulations, links to references, and the interchanges of ideas in a chat room; they can be organized to be accessible in a searchable form; and they are useful in parallel problem solving. Portfolios can be used for student evaluation of personal learning, for program evaluation by showing the development of learners through their products to a team of evaluators, and for making archives for future generations of learners to build on. An electronic group portfolio developed by preservice teachers promotes reflection and discussion about what should be included, thus teaching cooperative activity and increasing social skills in a new medium. Group portfolios promote synergy and peer review, are a teaching device for both peer and teacher instruction, and support student choice. They are particularly appropriate for case studies, problem-based learning, and team teaching. Portfolio design is discussed, and techniques for capturing material electronically are presented. Links to web sites containing examples and references are interspersed throughout this document. (TD)

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DEVELOPING COLLABORATIVE ELECTRONIC PORTFOLIOS FOR PRESERVICE TEACHERS IN COMPUTER MEDIATED LEARNING

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DEVELOPING COLLABORATIVE ELECTRONIC PORTFOLIOS FOR PRESERVICE TEACHERS IN COMPUTER MEDIATED LEARNING

The portfolio provides a mechanism that can be used to represent excellence and variety in the work of one preparing to be a teacher. The use of portfolio is a logical response to the current interest in authentic assessment, situated learning, lifelong learning, or integration of theory to practice. A portfolio is not only product-based, but it provides student autonomy and professionalism as each student chooses what to present in her or his portfolio. The purpose of this discussion is to review the implementation of portfolios with preservice teachers and to describe appropriate electronic artifacts for potential inclusion to an electronic portfolio.

Background for Portfolio Development

Traditionally portfolios have been used to show the work of professionals, such as the classic example of the artist's portfolio (see http://www.art-portfolio.com/). This concept has recently been extended into the realm of education with the teaching portfolio, which has been modeled after the portfolio of the beginning architect. A reference list of educational portfolio articles in ERIC is available at http://cisi.ospi.wednet.edu/CISL/Strategies/PRTFRESEARCHED.html . The teaching portfolio, according to Barton and Collins (1993) is composed of artifacts (things produced as part of the normal work), reproductions (documents describing typical events which describe the work of the portfolio developer), productions (documents such as reflective statements which have been prepared particularly for the portfolio), and attestations (descriptions of the developer's work which are created by others, like recommendation letters). See teaching portfolios at http://www.temple.edu/ATTIC/portfolio.html or http://www.ilstu.edu/depts/CAT/prepaport.html. To create an Internet portfolio see http://www.astro.uni.torun.pl/~vario/java/help/manager/CreatePortfolio.html .

In a computer mediated learning (CML) environment the document is the primary form of artifact. Most artifacts in electronic portfolios are documents that show products that result from the learning experiences. For one example of CML artifact development see http://www.kn.pacbell.com/wired/donner/ for development of a scrapbook from a simulation. Processes that take place in learning do not necessarily yield products. These processes and events are evidenced by reproductions such as video, dialogue capture, or the interchange of ideas in a CML chat room or virtual reality learning space. A third kind of portfolio component is the attestation, a document prepared by another or by others. In a CML environment this may be testimony of others in a group as to a member's performance, reports by a teacher, or evaluation by an external mentor. Productions comprise another component of portfolios which include goal statements to describe why a particular product was created, captions to describe the document, and reflections to describe growth over the development of the product or over several products. See creating an electronic portfolio at http://206.252.190.23/port/index.html. For software to build portfolios see http://www.xemplar.co.uk/primary/Toolboxes/PBschool.html.

Artifacts Shape Mental Processes. Anything physical or tangible can be called an artifact. The objects in our environment and our knowledge of them determine the way in which we perceive our environment (see for example http://www.duq.edu/PT/RA /RA.html). If a learner has only a few learning tools these

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are the tools which will be used. Our understanding of the artifacts shapes the way we use and interact with them (see a description of artifacts in science at http://www.utexas.edu/depts/tnhc/.www/crayfish/astacidea/astacidea.html).

Uses of Portfolios

Portfolios Monitor Progress: Portfolios can be used to monitor progress. In traditional use, the teacher examines the student's portfolio periodically and evaluates the growth of the student. See http://206.43.189.116/library/portfolio.htm. Furthermore, in CML the portfolio is used instructionally for student evaluation of personal learning. For the individual, the portfolio shows the kinds of products and the sophistication of the teams with which the individual has been involved. At the group level, the group portfolio shows how the group has developed products, which may be of interest to other groups in parallel problem solving situations, e.g., teaching cases. In order to become effective and productive lifelong learners, students systematically reflect upon their own work. See comparative sample portfolios at http://www.uno.edu/~drcom/graphics.html.

Portfolios for Program Evaluation. Portfolios may be used for the purpose of program evaluation. There is nothing better than being able to show the development of learners through their products to a team of evaluators. Example products, which illustrate the accomplishment of programmatic goals, are effective productions in an evaluative sense. To see a list of possible components of a portfolio for an Internet course see http://mailer.fsu.edu/~slynn/4710assignments/4710portfolio.html. Selective use of portfolio examples can show that in general the program goals have been reached. See http://watson2.cs.binghamton.edu/~loland/whatis1.html.

Portfolio as Archives. Portfolios can be used to make archives for others to use after the learners depart. This multigenerational use will increase the learning of future generations of learners. See http://www.soc.hawaii.edu/~leonj/leonj/leonpsy/gc/intro.html. Care must be taken to insure that copyright is not violated see http://www.unc.edu/courses/jomc050/copyright.html.

Group Portfolios: In CML, the group preservice teacher portfolio promotes reflection and discussion leading to consensus as to what should be included. Reflection leading to consensus is important as it teaches cooperative activity and increases social skills in a new medium. The group portfolio:

- Promotes synergy as its development stimulates questions in others, provides opportunity for scaffolding when some do not know concepts, and in reflection on composition, as well as development, it promotes position defending
- Promotes peer review, especially when individuals contribute completed activities and documents. Peer review sets the standards for peer performance. Less capable/advanced members will strive to match the level of others and this provides challenge and a goal level that is seldom set in individual learning settings
- Is a teaching device for both peer and teacher instruction. The review and comment process teaches editing skills and composition/organization of idea.
- Portfolios are recommended for all forms of teaching in which students are to produce real products for authentic audiences.
- Support student choice and should not be totally controlled by teachers.
- Allow students to think about and reflect on the value of their productions and artifacts.
- Leads to more positive motivation and to more use of the content than traditional assessment.

See example portfolios at http://www.essdack.org/port/example1.html. Group portfolios are particularily appropriate for case studies, problem based learning, team teaching, and example IEP meetings.

Portfolio as Research: The group portfolio is researched based in the sense that all can look at the work of others and draw upon it. It is also metacognitive in the sense that it causes all participants to think about their thinking and their production during its creation. This is particulatily important in problem based case studies. See portfolio development for college students at http://sirius.cba.ohiou.edu/~mgt300/ESP/portfolio.htm.

Portfolios Improve Writing: Collaborative writing is improved through portfolio creation. See webfolios at http://www.gsh.org/wce/schelle1.htm. This happens through modeling, watching what others do, and feedback, when others provide suggestions, which improve what is created. Transactional writing is improves in the areas of clarity, organization, and correctness. Expressive writing becomes more elaborative and speculative. Finally learning is improves through understanding, idea formation, decision making and self-discovery. See writing in portfolios at http://www.eduplace.com/rdg/res/literacy/assess6.html.

Portfolios to Contain the Products in Collaborative Production: Collaborative processes are designed to produce products. In authentic settings products are designed to be displayed or used rather than graded. Therefore the best mechanism for the display of products is the portfolio. The portfolio provides a way of collecting products so that they can be displayed and so that improvement over time can be seen by their changes during development. For a portfolio see http://www.io.com/~tracy/portfolio/index.html . This fits in nicely with the archiving capability of CML and can be used to form the base for a multigenerational archive, which can be mined by future generations to improve the learning curve of new students. For a newsletter on portfolio development in teacher education see http://www-tep.ucsd.edu/TEP_MAIN_PAGES/portfolionews/PNHomePage.html.

Designing the Portfolio

Essential design components of portfolios are goal statements, captions, objectives, and self reflection (Mokhtari, Yellin, Bull & Montgomery, 1996). Each portfolio has a goal statement that describes why the portfolio has been assembled. Each piece of evidence should have a caption that describes the document and a rationale for why each piece is included in the portfolio. Students should develop objectives for their own portfolios. The process of self-reflection should be taught in conjunction with the development of the portfolio. Teaching becomes collaborative when portfolios are used as the learners choose what they will work on and include in their portfolios. The process of evaluation teaches that evaluation is a dynamic process. For an example of student products on the web see http://curry.edschool.virginia.edu/curry/class/edlf/589_004/sample.html.

A CML portfolio for a teacher (from Bull et al. 1994) might include teaching documents, e.g., syllabi, lesson plans, study guides, curricula, and examinations. The portfolio would include instructional materials such as case studies, laboratory manuals, course contracts, instructional aids, and concept maps. There would be academic products such as publications, abstracts, and journal article reviews. And, finally personal documents such as a curriculum vita, self-assessments, and autobiographical sketch and a statement about teaching philosophy. In addition to these artifacts there would be productions, reproductions and attestations, although these might not be represented electronically or they may be presented electronically on a CD-ROM. See http://www.ash.udel.edu/ash/teacher/portfolio.html.

The components of a portfolio are influenced by the time in a person's career (see Bull, 1994), as well as the desires of the learner. Other factors, which may influence portfolio components, include requirements for the next course or the next level of training, expectations of employers and experts in the field and licensure requirements. For a system of building portfolios see http://www.acc.ilstu.edu/spsins1.htm. For a portfolio review listing required preservice teacher

components see http://www.snc.edu/~kleies/portfolio.html. For a book on professional portfolio development see http://www.skylightedu.com/TrainCo/portfo.htm See directions for focused portfolio design at http://www.umanitoba.ca/student/employment/book1/portfoli.html.

Mechanical Features of Electronic Portfolio. The CML electronic portfolio has some mechanical feature making it more advantageous than the traditional paper and pencil portfolio. The electronic portfolio can be organized to be accessible to others in a searchable form, e.g., through Lotus Notes. This facilitates its use as a source document when it is part of an archive. Other groups in the same cohort can use archives or they may be used multigenerationally by other groups at a later time. The electronic portfolio is very useful in parallel problem solving where different teams can look at the development of solutions of others who possibly have used alternative processes or strategies to solve complex problems. For a list of sites related to various kinds of portfolio development see http://www.neat-schoolhouse.org/Office/Teacher/Assessment_Information/Portfolios.html.

Developing a Portfolio on CD-ROM. Boulware and Holt (1998) present information on ways to develop a portfolio stored on a CD-ROM disk. One recommendation is to develop a script to organize their materials before the CD is created. When the script is complete, then audio and visuals are continuously added. This approach allows the intention of the teacher to focus the CD rather than the available audio and video drive the portfolio development. Permissions must be collected before visuals are used, particularly of students.

Techniques for capturing material electronically in a Teacher's Portfolio: Artifacts within components is described as both its traditional form and in it Internet form if the component is likely to be part of an electronic course. In some cases, several approaches to recording the component are provided. Portfolio components are grouped as teaching documents, instructional materials, samples of student work, academic products related to teaching and personal documents that may be included in a portfolio. URLs are provided as examples to be included in a portfolio.

Teaching Documents--Syllabi: The traditional syllabus is presented on paper and can be scanned into an electronic document or entered from a computer file. The Internet syllabus may be more complex. Internet syllabi can reside on webpages, in proprietary programs, e.g., Virtual University, on CD-ROM, which are mailed out with a course, or on a local area network. Most Internet syllabi for fully webbed courses have links to local sites and remote locations, which will need to be reactivated, if the syllabi are to be fully understood. This means that there must be activation directions or an activation program that will reconnect the links when the portfolio is captured electronically. The exception to this is when the portfolio is on a website and is accessible through a web browser. See portfolio directions with syllabi at http://www.oaa.pdx.edu/CAE/WTPI98/hakanson/gene/teach.htm .

Teaching Documents--Study Guides: The traditional paper study guide can be scanned in or entered electronically to add to the portfolio. The electronic study guide may be located on a website, CD-ROM, proprietary program or on a local area network. Electronic study guides may be complex containing text, graphics, interactive assessment, video, interactive tutorials, simulations, questions with tracking depending on the correctness of ones answer, tracking based on pretest scores or formative assessment and the like. Capturing the electronic study guide requires explanations of how they are designed to work should be included if activation in a new environment is not easily attainable. See http://syllabus.syr.edu/swk/gmgross/swk361/study.htm .

Teaching Documents--Reading Lists: Traditional reading lists can be scanned in or entered electronically. Electronic reading lists may have links to the actual documents, to libraries that hold the

documents and will loan them, or to places that will make them available electronically. Some electronic reading lists will provide hyperbooks which students can read in a linear or non-linear fashion. Some hyperbooks will allow student or teacher annotation. Teachers who prefer to guide students through passages or articles in teacher specified sequences may develop tours through electronic readings. This can be done using tour software or downloadable book marks lists. When these are provided as part of the portfolio explanations should be provided if the paths are not activated. See http://home.okstate.edu/homepages.nsf/toc/isdhome.

Teaching Documents--Bibliographies: Traditional and electronic bibliographies look about the same. Both are listing of books and readings that are used or referred to in the course. Electronic bibliographies may be linked to their source documents if they reside on the Internet or a local area network. Sometimes article archives are available for national access but more likely they are password protected and available only to members of the class. Availability may be through a local area network, proprietary programs or on a website using a browser and a class password. See http://www.people.virginia.edu/~djp2n/biblios/biblio.html .

Teaching Documents--Tests: Paper and pencil tests can be scanned into the electronic portfolio or entered from a computer. Tests which are resident in an electronic form may be set up so that students can take them at any time, take them at only specific times, work on them individually, work on them collaboratively, designed as preassessment, formative assessment and as summative assessment. Electronically provided tests can be customized based on students responses to items, self scoring, record and score immediately to the grade book, include video presentations, use simulations as part of the testing, and even provide experiments which the students can run in a simulated laboratory or field environment. Most of these application will need to be explained as reconnecting them after they are captured electronically is usually too difficult unless the portfolio is resident on a website. See http://teams.lacoe.edu/documentation/classrooms/gail/teacher/assessment.html .

Teaching Documents--Lesson Plans: Traditional lesson plans can be scanned in. Electronic lesson plans are likely to take the form of scripts, audio recordings of actual plans in action, videos and the like. If multi-track presentations are available based on student choice all of the tracks should be described. In most cases it is easier to replicate the electronic lesson than it is to provide just the lesson plan if the information is presented in a single track, e.g., a PowerPoint presentation with Streaming Audio. See http://www.ecsu.ctstate.edu/personal/faculty/salihd/evaluation.html .

Teaching Documents--Classroom Management Systems: Traditional management systems described on paper could be scanned into an electronic format. In electronic courses the management systems will vary depending on whether the class is synchronous or asynchronous. In a synchronous format management will be controlled by the teacher and can be exemplified by capturing teacher intercessions in discussion, class presentations, lectures and the like. The system should be described and examples provided. In an asynchronous format the teacher is not usually present. Therefore the students are the ones who should create the management system, usually as part of a group discussion or brainstorming session. This dialogue can be captured and the rules that the students generate and post can be displayed. The major teacher responsibility is to deal with flaming and to contact students who have fallen by the wayside. These procedures too should be documented and described. See http://dana.ucc.nau.edu/~tmb9/bregant/portfolio.html .

Teaching Documents--Course Schedules: Traditional course schedules can be scanned. Electronic course schedules are somewhat more complex. They may be under teacher control, teacher and student control, or totally under student control. The teacher controlled course schedule is usually a component

of the syllabus or it may be a separate page that is linked to the syllabus. In either case it can be captured and easily included in electronic form. The teacher and student controlled course schedule has components which are set up by the teacher which can be captured and recorded easily. Student components of the course schedule may take the form of annotations, requests for additional instruction or different instruction, etc. Student may also create times when they will meet to discuss projects, lectures, tests, etc. These are more difficult to capture but should be exemplified in the portfolio. Student driven schedules are prominent when the students set their own learning goals and work collaboratively to accomplish the learning. These schedules can sometimes be captured but are usually underrepresented in teachers' portfolios. See http://brillig.nebwesleyan.edu/~glarose/clases/portfolio/ .

Teaching Documents--Assignments: Most traditional assignments are assigned in a paper and pencil format and can be copied. Electronic assignments can be much more complex. They can involve travel on the Internet, use of a variety of simulated, animated, or virtual experiences, tours of sites, conduct of experiments and the like. Most of these should be describe if they are included in the portfolio. Provision of the URLs will assist evaluators if the sites are not reactivated in the portfolio format.

Teaching Documents--Handouts: Traditional handouts can be copied electronically. An equivalent handout in electronic form can range from print material to any of the activities that we have already discussed. These should be described in the portfolio if they are not activated.

Teaching Documents--Curricula: Traditional curricula are the content and objectives for the teaching presentation over a specified period of time. This is usually a paper document although it may have other aspects such as teaching materials which are not print. Electronic curricula are much the same except that any of the teaching materials can be embedded in the curriculum. If these are not activated they should be described.

Teaching Documents--Review Sheets: Review sheets are usually provided on paper prior to a test in the traditional setting. In an electronic course they may be provided in the same manner. One may also include self-checking online assessment which students can use for practice. They may be the focus of a chat room or a threaded discussion. In some cases students will meet in a virtual classroom to work on them collaboratively. Copies of this interaction should be provided as part of the portfolio.

Instructional Materials--Slides/Transparencies: In many traditional classes teacher use slides to present images of things that cannot be brought into the classroom. These can be digitized and captured in an electronic format. Slides of things, PowerPoint slides and many other image captures are available electronically.

Instructional Materials--Laboratory Manuals: These may be the same in both traditional and electronic settings, paper or electronic copy. In fully webbed courses the laboratory manual will probably relate to virtual rather than traditional experiments. In this case it may provide tutorials, simulations or virtual experiments in the manual.

Instructional Materials--Case Studies: Traditional case studies are narrative and provide all of the information to the students at the beginning of the case. There is little difference in the traditional and the electronic formats. Diagnostic cases on the other hand allow students to ask for more information, do diagnostic tests, wait to see what happens, etc., these are used more often in an electronic format. If the various tracks that have been designed are not operable they should be described so that the evaluator can understand the process fully. See http://home.okstate.edu/homepages.nsf/toc/isdhome.

Instructional Materials--Multimedia Presentations: Multimedia classroom presentations are the same whether used traditionally or in an electronic format. They can be captured electronically and shown in full motion in the portfolio display. More individualization can be built in the electronic format and if multiple tracks are provided these should be activated or described in the portfolio.

Instructional Materials--Animations: Animations are developed on computers, video, or CD-ROM for either classroom display or for use electronically on a network or the Internet. They should be recordable directly in any electronic portfolio format.

Instructional Materials--Project Requirements: Project requirements are usually presented as a paper document in traditional settings. In an electronic format they may be student developed and contracted with students. If this approach is used it should be explained and samples of the student developed requirements illustrated. In many cases it is necessary to teach students how to develop criteria for evaluation before they can develop project requirements with which they are comfortable. These teaching directions should be included.

Instructional Materials--Individualized Student Materials:
Individualized materials can take many forms in the traditional classroom. Things, readings, workbooks, modified problem and instructional set, etc can be provided. These can be scanned in, photographed, videotaped, etc. In the electronic setting there is an even greater panoply of instructional assets which can potentially be provided. Most adaptations or individualizations increase or decrease complexity, step-size, reading level, etc. In addition adaptations may include simulations, tutorials, virtual experiments, virtual field experiences, and the like.

Instructional Materials--Course contracts: Course contracts are paper products traditionally and either electronic pages or electronic forms in the electronic environment and capture easily for the electronic portfolio. See http://home.okstate.edu/homepages.nsf/toc/isdhome.

Instructional Materials--Tables of Specifications: Tables of specifications are used to show how tests are developed commensurate with the amount of time spent on objectives and the cognitive level at which the objective was written. They can be shared with students as study guides or viewed by evaluators to show that the tests were representative of the materials taught in the class. They can be easily scanned into the electronic system.

Instructional Materials--Instructional Aids: Almost anything can be used as an instructional aid. Generally in traditional settings instructional aids are non-paper presentation or example mechanism. These can be digitally photographed for capture electronically. The scope is somewhat broader in the electronic course. Here aids can include job aids, performance systems, photographic representations, diagrams, charts, video of objects, and the like. All of these can be reproduced in the electronic portfolio. Any representation that is not activated should be described. See http://home.okstate.edu/homepages.nsf/toc/isdhome.

Instructional Materials--Concept Maps: Teachers or students show diagrammatically the relationships between concepts and ideas with concept maps in traditional settings. These are graphical portrayals of the relationships between pieces of information. These can be scanned in when developed in traditional classes and are created in electronic form when done as part of a webbed class. When done electronically these are usually developed by a program designed to create concept maps whose output is loadable into other programs. Either way concept maps can be easily incorporated into the electronic portfolio.

Instructional Materials--Computer Software: Computer software obviously is already resident on the computer and can be placed directly into the electronic portfolio. If the software need data to be activated the location of example data should be included or linked to so that the porfolio reader can experiment with the program if that is desired.

Instructional Materials--Simulations: In traditional settings simulations are likely to be paper tasks where several students read or interact based on a script describing how different actors would respond in a given situation. This can be scanned into the portfolio. In an electronic setting the action may play out for the learner in a precreated scenario or the learner may be an active participant. Active participation usually is a synchronous activity. This kind of activity can be captured as an electronic narrative.

Instructional Materials--DemonstrationVideo/Film: Copies of films and videos created by the teacher can be digitized and included at least in synopsis form in the portfolio. If permissions were not obtained from all participants the materials should not be copied electronically.

Samples of Student Work--Papers: Student papers can be scanned into the electronic portfolio. Papers developed in an online course is presented in an electronic format and can be directly transferred to the portfolio.

Samples of Student Work--Course Grade/Test Profiles: In traditional classes grade profiles, showing the distribution of student grades, are constructed by hand and can be scanned into the electronic portfolio. In the online course the computer that scores the test in most cases generates these distributions and they are therefore available directly.

Samples of Student Work--Projects: Projects traditionally are either paper or tangible realia. These can be scanned or videoed in operation to show how they work. Online projects are potentially more diverse but because they are already digitized easy to capture for the portfolio. The online project as it is designed to perform should be activated or described in the portfolio.

Samples of Student Work--Photographs, Videos, or Audio Recordings: Any visual or audio recording can be translated into digitized examples for the portfolio. Photos that are not digitized can be scanned. This works in both the traditional and the electronic environment.

Samples of Student Work--During-Course Feedback/End of Course Evaluations: In traditional classes this can be tests, questionnaires, interviews and the like. All of these forms are scannable and can be placed in the electronic portfolio. In online courses the data is usually from evaluation forms which are emailed directly to the course instructor. These can be saved and summarized or inserted directly as examples in to the electronic portfolio.

Academic Products Related to Teaching--Research and Publications: Research is presented in written form in both traditional and electronic settings. This makes it easy to place it into the portfolio. A caution should be noted here: research that is placed on the web is considered published by some journals and therefore it is not later acceptable for publication by them. This caution should be noted if the electronic portfolio is to be placed on a website that is not password protected.

Academic Products Related to Teaching--Case Study Write-Ups: Students develop case study write-ups in traditional classes and present them as paper products that are scannable. In the online format students discuss cases and come to conclusions in chat rooms, on bulletin boards, on threaded databases. These

then become collaborative documents. Each can be easily captured for the portfolio but should be explained so that an evaluator can understand how the case-based data were generated.

Personal Documents: The traditional resume or vita can be easily scanned into the electronic format, as can other personal documents such as autobiographical sketches, statements about philosophy of teaching, letters of recommendations and peer assessments. All of these may be included in the electronic portfolio but there is no difference between the traditional and the online versions unless the online documents are pictorial or moving as in video.